

Space Weather and the Tracking of Deep Space Probes by the NASA Deep Space Network (DSN): The Galileo and SOHO LASCO Experience

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From the beginning of space exploration, radio links with spacecraft have been used to control, navigate and return data from deep space missions. When the radio paths of these spacecraft pass close to the Sun, propagation effects due to changes in the solar wind plasma — and representing space weather — can adversely affect the performance of the links, resulting in the degradation of communications.

In recent years, considerable progress has been made in understanding how coronal features and events observed by white-light coronagraphs affect radio propagation. As a result, the unprecedented near-continuous coronal imaging by SOHO's LASCO — to heliocentric distances as large as 30 R. — provides the DSN with an invaluable new tool for diagnosing and forecasting communications problems produced by inclement 'solar weather.' The purpose of this paper is to demonstrate the utility of the LASCO images to the DSN by describing problems encountered by the Galileo mission during the period of February 3-7, 1997. Disruptions in communications with the Galileo spacecraft led to the loss of scientific data from Jupiter, which was apparently caused by coronal mass ejections observed by LASCO off the west limb.